Architectures for Mobile Wireless Publish/Subscribe Networks

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 DEC 2007	**N/A**	

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Architectures for Mobile Wireless Publish/Subscribe Networks	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **PreCache Inc.**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**UU**	**14**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Information-Centric Mobile Wireless Applications

- Consumer Alerts
- Location-Based Services
- Multiplayer Online Games
- Battlefield Awareness
- Distributed Sensor Networks

Information flows achieved via request/response interactions with continuous polling by recipients

The Publish/Subscribe Communication Style

- Publish/Subscribe Networking
  - Wide geographical span (global Internet)
  - Huge numbers of publishers and subscribers
  - High volume of notification traffic

Publish/Subscribe Functionality

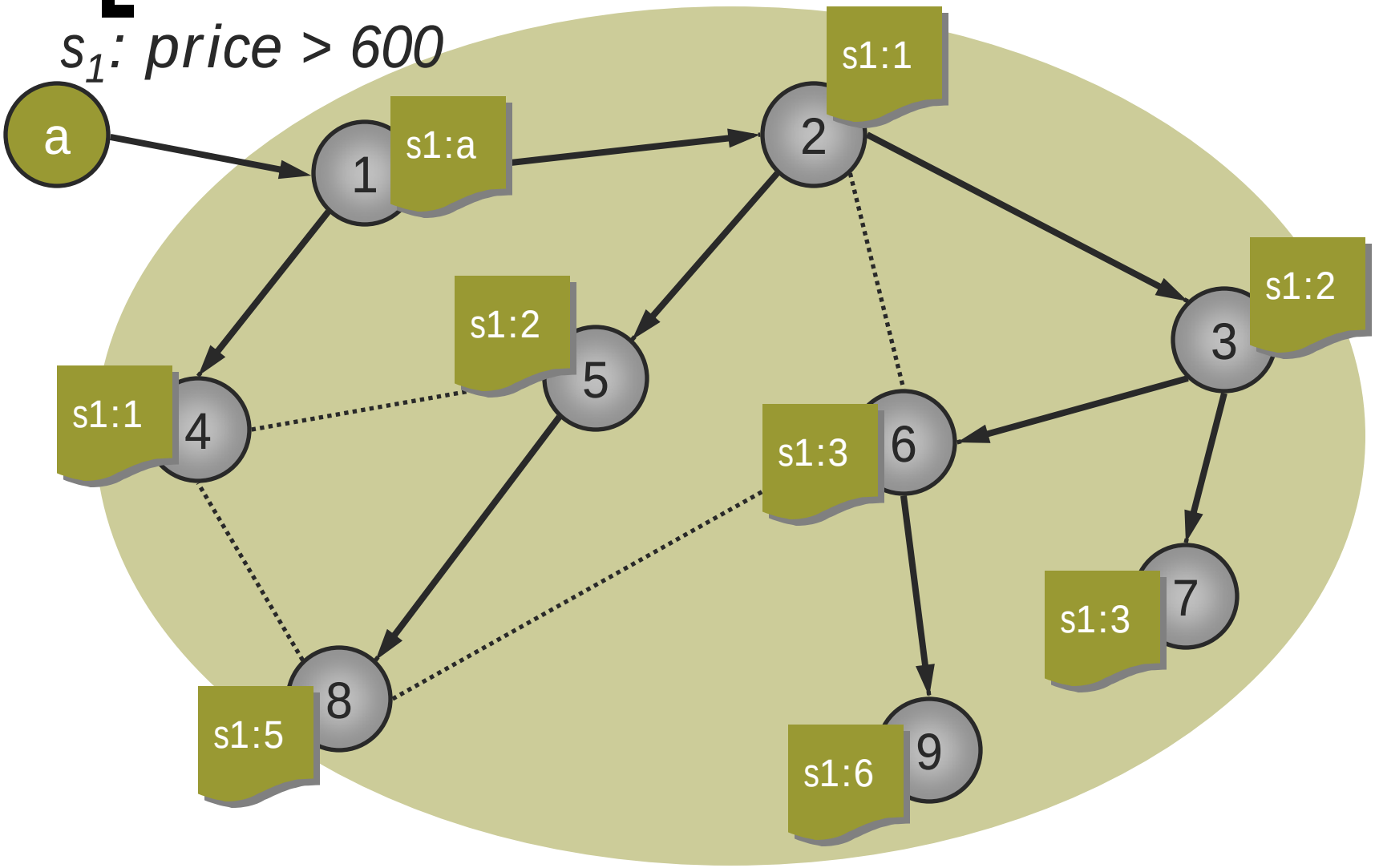
- Create notification
- Validate notification
- Authenticate publisher
- Deliver notification to network
- Cache notifications for deferred delivery

- Create subscription
- Validate subscription
- Authenticate subscriber
- Deliver subscription to network
- Combine subscriptions
- Process matching notifications

- Route notifications
- Route subscriptions
- Match notifications to subscriptions

SIENA Content-Based Routing

Subscription Forwarding



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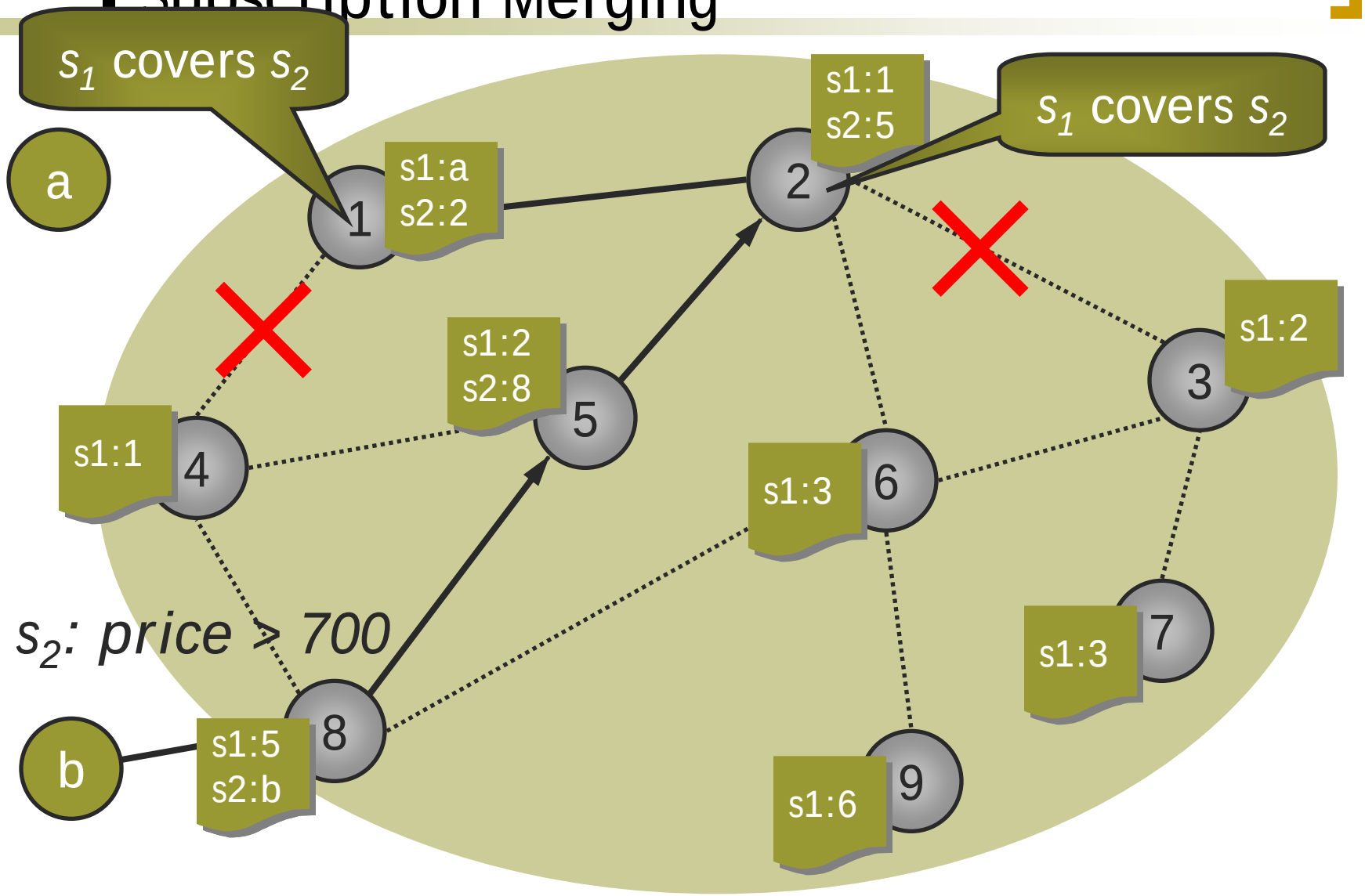
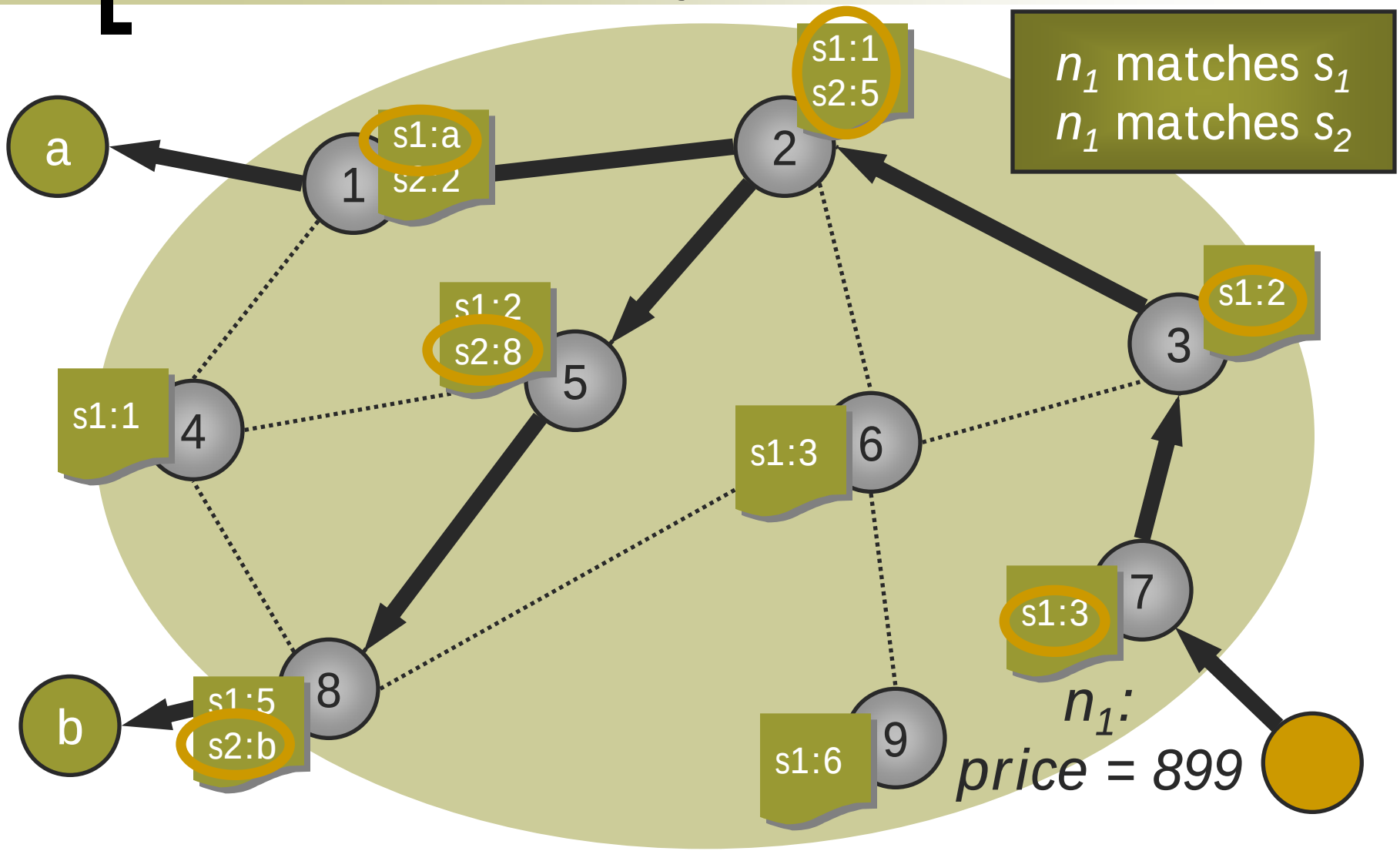
Subscription Merging



SIENA Content-Based Routing

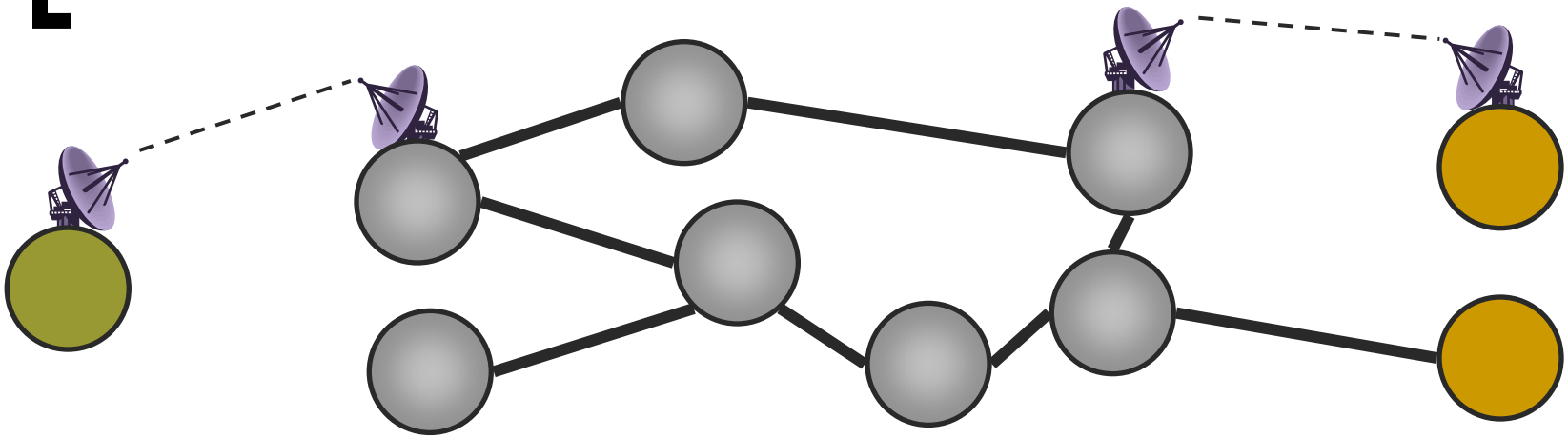
Notification Delivery



Potential Advantages of Pub/Sub for Mobile Wireless

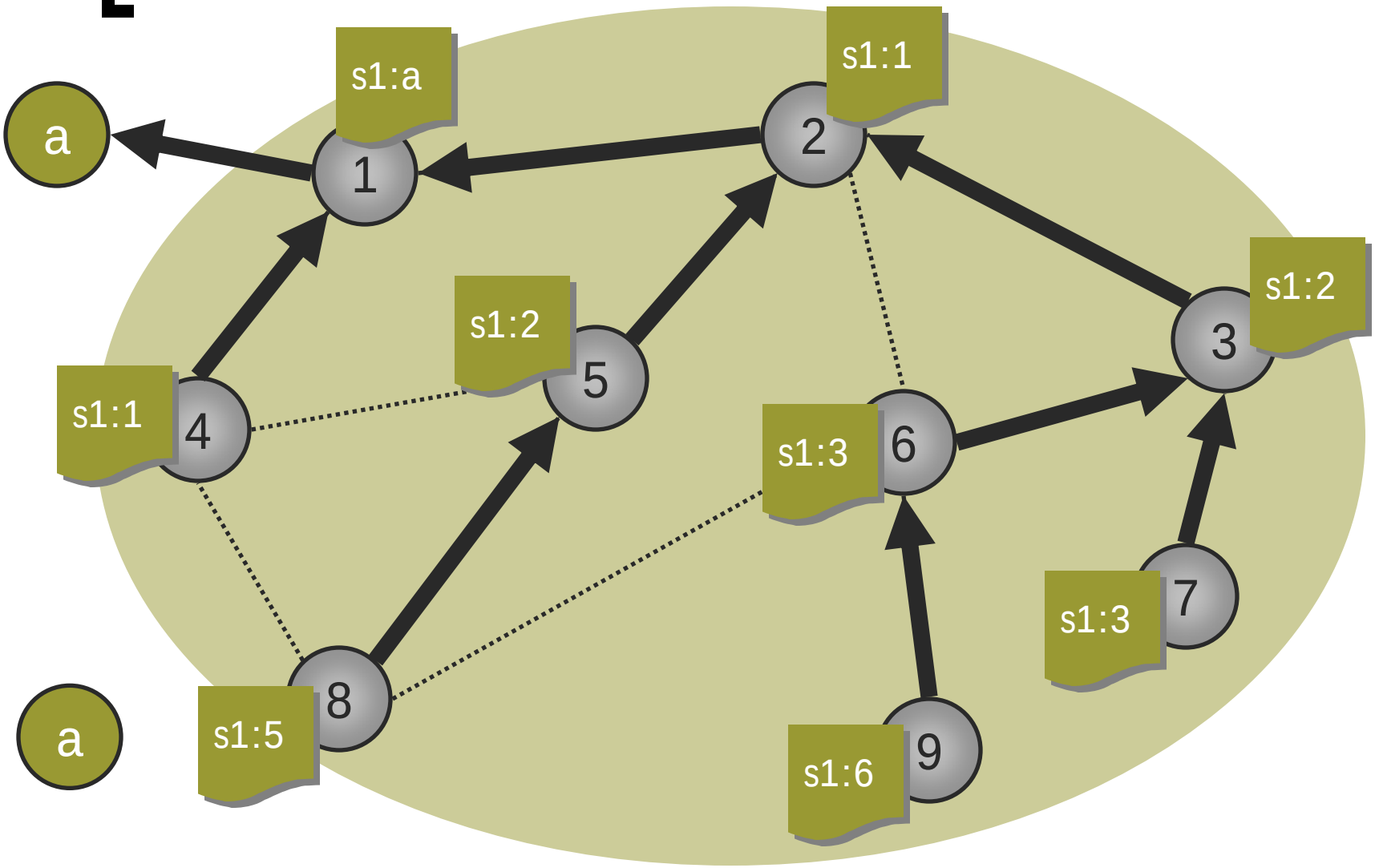
- Decoupling of publishers and subscribers aids *mobility*
- Decoupling of publishers and subscribers aids *disconnected operation*
- Asynchrony and absence of polling aids *resource preservation*
- Multicast delivery can exploit *intrinsic broadcast properties* of wireless

Mobile Wireless Architecture 1
Wired Distribution Network

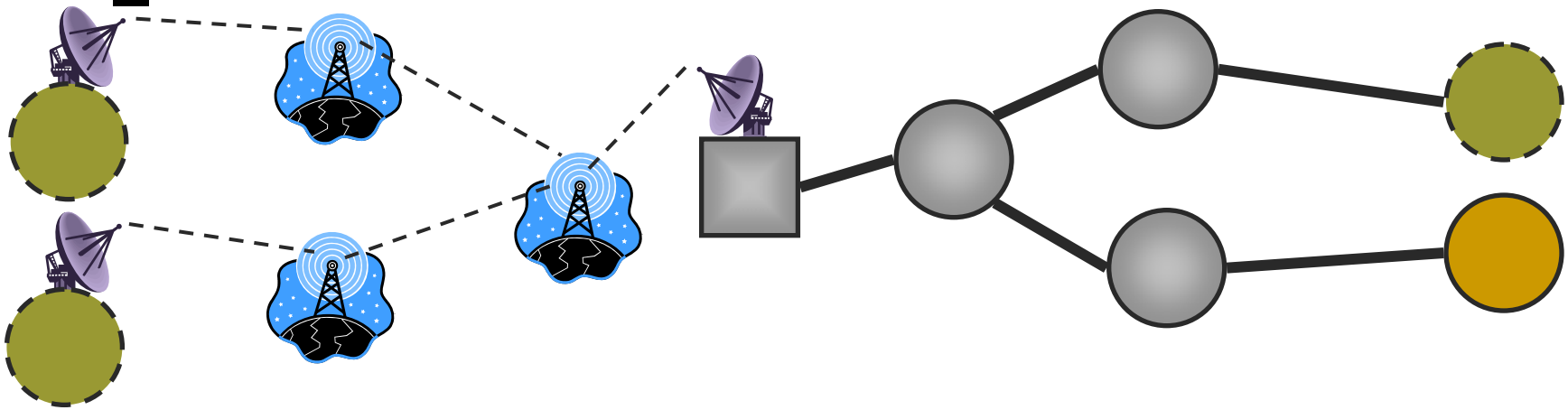


- Wired or mobile wireless publishers
- Mobile wireless subscribers
- ✓ Retain nice content-based routing
- ☠ Routers must reconfigure routes as subscribers move
- ☠ Thrashing may result from frequent reconfiguration

Routing for Mobile Subscribers

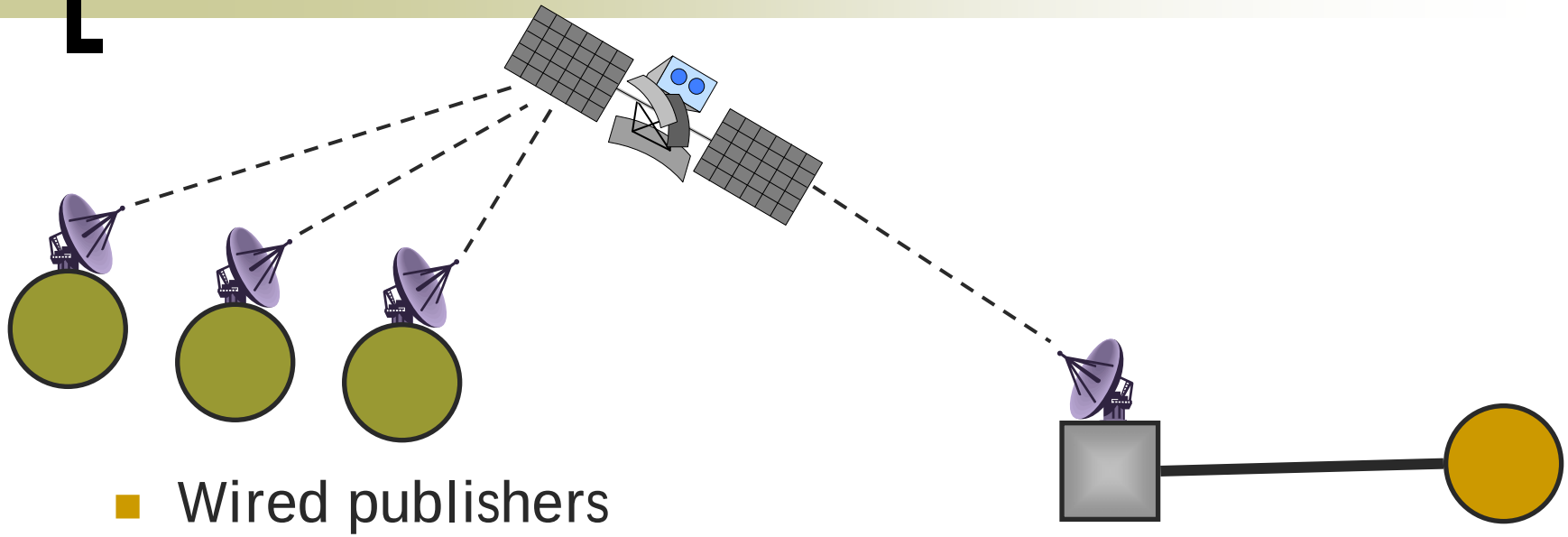


Mobile Wireless Architecture 2
Hybrid Distribution via Gateway



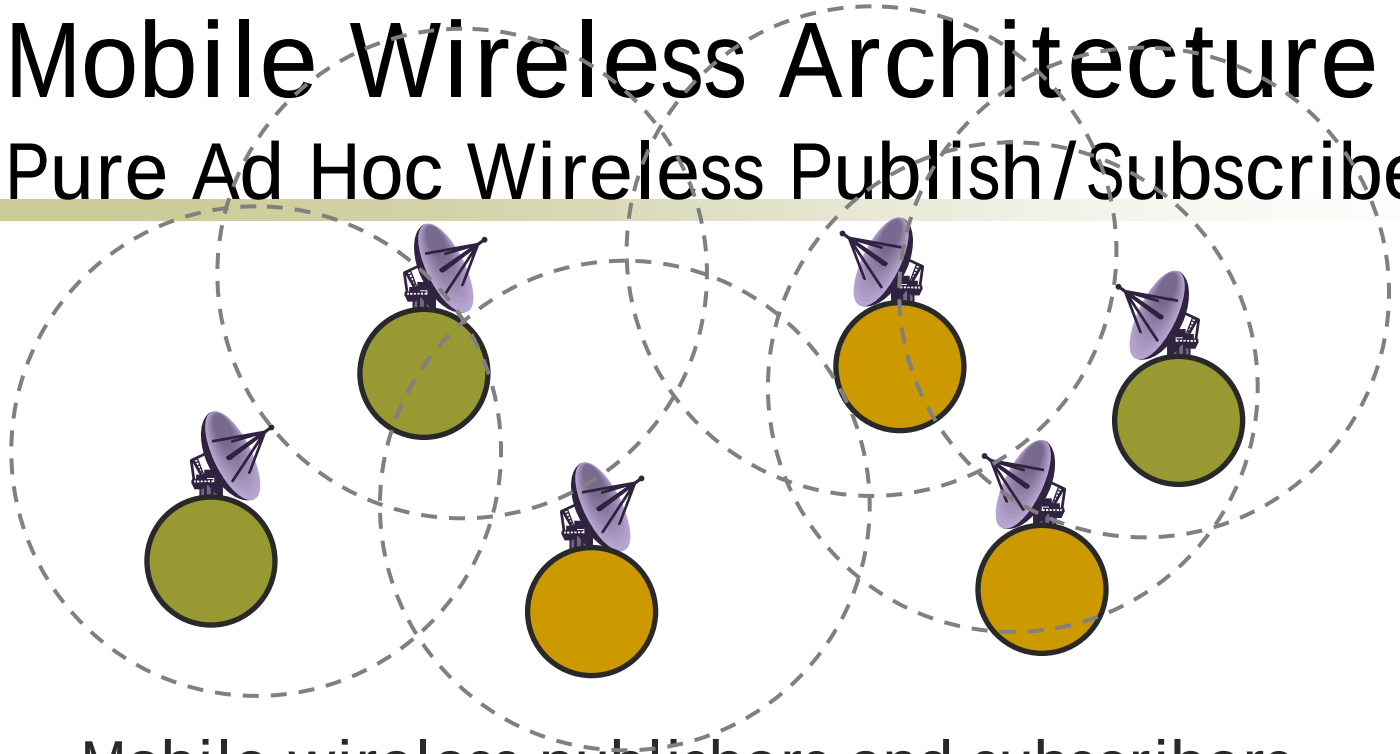
- Wired publishers and subscribers
- Mobile wireless notification recipients
- ✓ Supports legacy messaging (e.g., SMS)
- ☠ Cannot exploit subscriber location for routing
- ☠ Gateway becomes bottleneck under heavy traffic
- ☠ Difficult to deploy new routers in legacy network

Mobile Wireless Architecture 3
Satellite-Based Distribution



- Wired publishers
- Mobile wireless subscribers
- ✓ Unlimited broadcast delivery to subscribers
- ✓ No need for complex content-based routing
- ☠ Subscriber devices must perform all matching
- ☠ High notification volume can overwhelm devices
- ☠ No reliability guarantees if delivery is one-way

Mobile Wireless Architecture 4
Pure Ad Hoc Wireless Publish/Subscribe



- Mobile wireless publishers and subscribers
- ✓ Partial broadcast delivery, with propagation
- ☠ Devices must perform all middleware functionality
- ☠ Subscriber devices must perform all matching
- ☠ High notification volume can overwhelm devices
- ☠ Difficult to achieve reliable delivery

Conclusion

- The publish/subscribe style offers many natural advantages to mobile wireless networks and applications
- Mobile wireless network architectures facilitate some of these advantages and reduce or eliminate others